THE AXIAL CANALS OF THE RECENT PENTACRINITIDÆ.

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The discovery of infrabasals in *Metacrinus* by Prof. Ludwig Döderlein,[a] which was made simultaneously by the present writer[b] in two other species of that genus and in *Isocrinus decorus*, has raised an interesting question in regard to the axial canals, through which runs the antiambulacral nervous system.

First of all, it may be mentioned that fifteen specimens of *Isocrinus decorus* have been examined to determine the presence or absence of infrabasals, which were found in every case; there is no trace whatever of any resorption, and the infrabasals appear to be constantly present in this species throughout life. Also, in six specimens of *Metacrinus* (five *rotundus* and one *superbus*) infrabasals were found as described and figured. Unfortunately, only three specimens of *Endoxocrinus parræ* (*Pentacrinus mülleri* of authors) were available for dissection; but all were similar, and in all *infrabasals were absent;* moreover, the inner ends of the basals had been somewhat resorbed. It is possible, therefore, that *Endoxocrinus* may constantly differ from *Metacrinus* and *Isocrinus* in the absence of infrabasals.

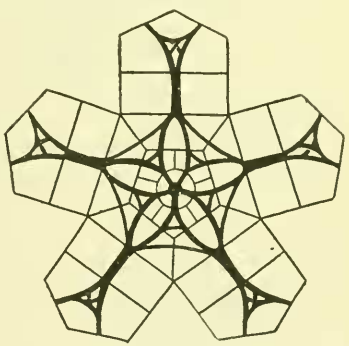

Fig. 1.—Diagram showing the course of the axial canals in Isocrinus decorus and Metacrinus rotundus.

Reichensperger,[c] in his paper on the anatomy of *Isocrinus decorus*, gives an account of the axial canals supposedly in that species; unfortunately, however, the figure he gives represents a specimen of

[a] Die Gestielten Crinoiden der Siboga-Expedition, p. 20.
[b] Proc. U. S. Nat. Mus., XXXIII, p. 671.
[c] Bull. Mus. Comp. Zool., XLVI, No. 10, p. 172 (fig. p. 173).

Endoxocrinus parræ, in which the conditions are quite different from those in *Isocrinus decorus;* the two II Br series represented, as well as the mode of origin of the cords, make the identification certain.

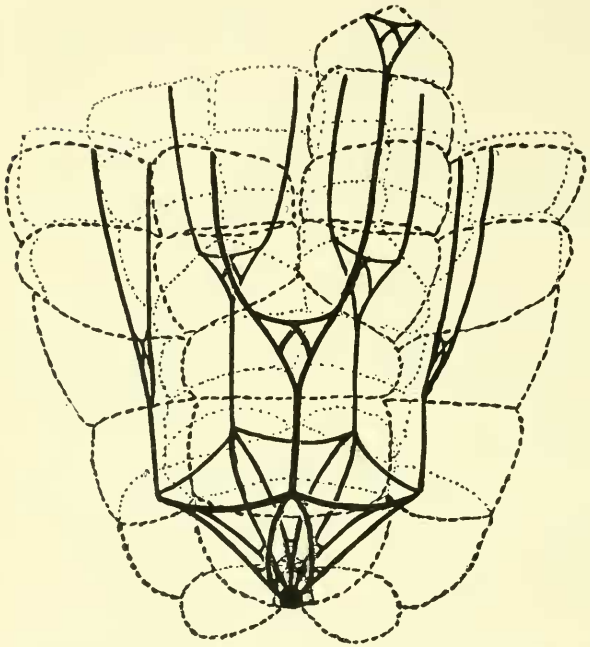

FIG. 2.—DIAGRAM SHOWING THE COURSE OF THE AXIAL CANALS IN ISOCRINUS DECORUS IN THEIR NATURAL POSITION.

FIG. 3.—PORTION OF STEM OF VERY YOUNG ISOCRINUS DECORUS, BEFORE THE DEVELOPMENT OF THE PETALOID SECTORS.

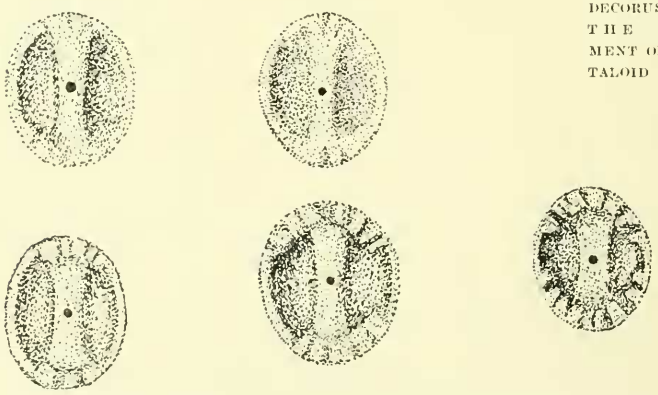

FIG. 4.—JOINT FACES IN A VERY YOUNG STEM OF ISOCRINUS DECORUS, BUT SOMEWHAT OLDER THAN THE STEM SHOWN IN THE PRECEDING FIGURE.

The axial canals in *Isocrinus decorus* and *Metacrinus rotundus* (figs. 1 and 2) appear to be similar, so much so that I can not find any differences between them; also, the canals in an individual of the

former, only 40 mm. in total length, with (ten) arms 25 mm. long, are indistinguishable from those in fully mature specimens. The infra-

FIG. 5.—LATERAL VIEW OF AN ISOLATED INFRABASAL OF ISOCRINUS DECORUS OR METACRINUS ROTUNDUS, SHOWING THE FURROW, WHICH FORMS HALF OF THE CANAL CONTAINING THE PRIMARY AXIAL CORD.

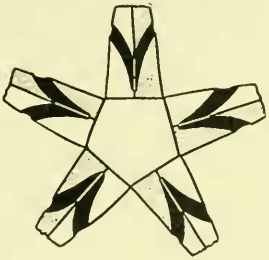

FIG. 6.—THE INFRABASALS OF ISOCRINUS DECORUS OR METACRINUS ROTUNDUS SPREAD OUTWARD, SHOWING THE COURSE OF THE FURROWS ALONG THEIR APPOSED SIDES.

FIG. 7.—THE CIRCLET OF INFRABASALS OF ISOCRINUS DECORUS OR METACRINUS ROTUNDUS, SHOWING THE APERTURES BY WHICH THE PRIMARY AXIAL CANALS LEAVE THE CIRCLET OF INFRABASALS TO ENTER THE BASALS.

basals in the very small specimen just mentioned (the stem of which distally still retains its larval *Antedon*-like character[a]) are in shape

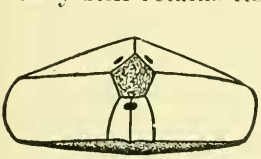

FIG. 8.—A BASAL OF ISOCRINUS DECORUS OR METACRINUS ROTUNDUS VIEWED FROM THE INNER END, SHOWING THE SINGLE APERTURE BY WHICH THE PRIMARY AXIAL CORD ENTERS FROM THE CIRCLET OF INFRABASALS AND THE TWO APERTURES BY WHICH THE TWO BRANCHES LEAVE THE BASAL AND ENTER THE RADIALS.

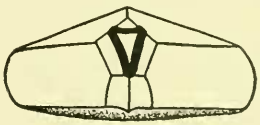

FIG. 9.—THE SAME BASAL, GROUND DOWN TO THE PLANE PASSING THROUGH THE CENTER OF THE THREE APERTURES TO SHOW THE COURSE OF THE CANALS AND THE TRANSVERSE CONNECTIVE WITHIN THE BASAL.

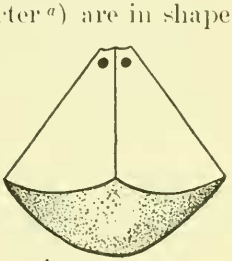

FIG. 10.—THE SAME BASAL, VIEWED VENTRALLY (DISTALLY), SHOWING THE TWO APERTURES BY WHICH THE TWO BRANCHES OF THE PRIMARY AXIAL CANAL LEAVE THE BASAL AND ENTER TWO ADJACENT RADIALS.

and proportions like those of the adult, though the basals are very short, and the radials much elongated.

The chambered organ in *Isocrinus decorus* and in *Metacrinus rotundus* lies within the dorsal part of the ring of infrabasals; the

[a] Dr. P. H. Carpenter says (Challenger Reports, XI, Zoology, p. 291, 1884) of the stems of young specimens of Pentacrinitidæ, "the petaloid markings are evident from the first, as might be expected;" but in the youngest specimen of *Isocrinus decorus* he figures (pl. XXXV, fig. 1), the distal part of the stem has the appearance of the stem of *Rhizocrinus*, except for the cirriferous nodal joints. This figure aroused my curiosity, and, on examining the original, I found that my suspicions were well founded. I have since been able to dissect part of a stem rather younger than that figured by Carpenter, and find (figs. 3 and 4) the articulations to consist of a pair of ligament pits separated by a longitudinal central ridge.

primary cords pass diagonally upward, through canals formed by corresponding grooves on the apposed sides of the infrabasals (figs. 5 and 6) (thus passing *between* the infrabasals), emerging exteriorly near the ventral surface of the ring of infrabasals (fig. 7), and immediately passing into the basals, through a single opening (fig. 8);

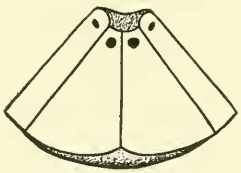

FIG. 11.—DORSAL (PROXIMAL) VIEW OF A RADIAL, SHOWING THE TWO APERTURES BY WHICH THE CANALS ENTER FROM TWO ADJACENT BASALS, AND THE TWO APERTURES BY WHICH THE CIRCULAR COMMISSURE LEAVES THE RADIAL.

FIG. 12.—THE SAME RADIAL GROUND DOWN TO A PLANE PASSING THROUGH ALL THE APERTURES, SHOWING THE COURSE OF THE CANALS WITHIN THE RADIAL.

FIG. 13.—A DIRECT (NOT FORESHORTENED) VIEW OF THE GROUND SURFACE OF THE SAME RADIAL.

within the basals the cords immediately fork (fig. 9), the two divisions diverging, and appearing on the ventral (distal) surface of the basals on each side of the median line, equidistant between the median line and the outer edge (fig. 10); a transverse connective (fig. 9) connects the two divisions of the primary cord just before they emerge on the ventral (distal) surface; entering the radials through two holes in the dorsal (proximal) surface (fig. 11) (which receive cords from

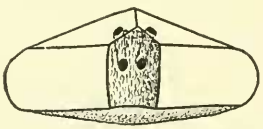

FIG. 14.—A BASAL OF ENDOXOCRINUS PARRÆ VIEWED FROM THE INTERIOR OF THE CALYX, SHOWING THE TWO APERTURES BY WHICH THE BRANCHES OF THE PRIMARY CORD ENTER THE BASAL, AND THE TWO APERTURES BY WHICH THEY LEAVE THE BASAL AND ENTER TWO ADJACENT RADIALS; THE COURSE OF THE CANALS WITHIN THE BASAL IS INDICATED BY DOTTED LINES.

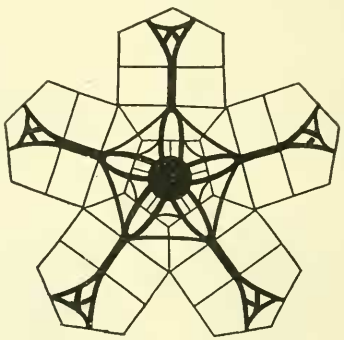

FIG. 15.—DIAGRAM SHOWING THE COURSE OF THE CANAL IN ENDOXOCRINUS PARRÆ.

two adjacent basals) the cords run almost parallel (figs. 12 and 13), then converge, coming together just within the distal surface of the radial; from the point where the two cords join a cord is given off on either side which passes through into the adjacent radials, forming a

circular commissure (figs. 1 and 2) which connects the points of union of the cords received from the basals, around the entire circle of radials. Leaving the radials through a single opening in the distal face, the canal continues undivided through the I Br_1 (figs. 1 and 2) forming a chiasma in the I Br_2 (axillary), as described by Reichensperger.

In *Endoxocrinus parræ* (and in *E. wyville-thomsoni* and *E. alternicirrus*, so far as I can judge from the figures in the Challenger Report), infrabasals are absent, and the primary cords pass into the basals by *two* holes (fig. 14), situated side by side, instead of by one; the course of the canals through the basals, radials, and arms is as described for *Isocrinus decorus* and *Metacrinus rotundus* (fig. 15). The double instead of single entry of the cords into the basals of *Endoxocrinus parræ* at first sight seems to be a difference of considerable importance; but in reality it has no significance whatever; the infrabasals, present at all stages in *Isocrinus decorus* and *Metacrinus rotundus*, are in *Endoxocrinus parræ* resorbed at an early age, and, with them, the inner end of the basals; now, as in *Isocrinus* and *Metacrinus* the cords fork immediately on entering the basals, it is evident that a very small resorption of the end of the basals will result in transforming the single hole into a pair, more particularly since the course of the cords is diagonally upward, at a comparatively slight angle to the inner surface of the basal (fig. 16).

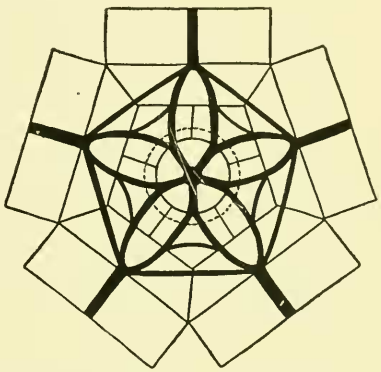

FIG. 16.—DIAGRAM ILLUSTRATING THE DIFFERENCE IN THE ARRANGEMENT OF THE AXIAL CANALS BETWEEN ISOCRINUS DECORUS AND METACRINUS ROTUNDUS AND ENDOXOCRINUS PARRÆ; THE DIAGRAM, WITH THE OMISSION OF THE DOTTED LINE, REPRESENTS THE CONDITION IN ISOCRINUS DECORUS AND METACRINUS ROTUNDUS; IN ENDOXOCRINUS PARRÆ THE INFRABASALS ARE ENTIRELY RESORBED, AND THE BASALS ARE RESORBED AS FAR AS THE DOTTED LINE, WITH A CORRESPONDING INCREASE OF THE SMALL CENTRAL AREA.

A very small specimen of *Endoxocrinus parræ* with arms only 26 mm. long has the infrabasals and interior ends of the basals already resorbed fully as much as in the adult, and has precisely the same arrangement of the axial canals, although the radials, as usual in the young of *Isocrinus*, *Endoxocrinus*, and *Metacrinus*, are much elongated, and the basals (which, as is the case in this species, form a compact closed circle) are very short.